

SCIENCE

And Technology Program



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FY 1999 - FY 2001

The ability to pump water to supply irrigation canals or provide hydraulic head to drive bypasses at fish screening facilities without first screening the pumped water has been long sought by water suppliers and resource protection agencies. Pre-screening flows to protect fish is extremely expensive, with associated high operational and maintenance costs. "Out of control" hydraulics from rapidly changing hydrographs in source waters create difficult challenges for meeting modern fish screen velocity criteria. Development of unscreened "fish friendly" lifts and pumps, supplied with modern screens in the pumped effluents, opens up vast opportunities for enhanced fish protection at diversion dams and any fish screen facility where hydraulic head must be developed for fish bypasses.

The overall goal is to determine the feasibility of using "fish friendly" pumping systems for water deliveries and fish collection/screening systems. Objectives include: (1) determine if any real differences exist between Archimedes and Internal Helical pumps at Red Bluff regarding mortality and injury of pump-passed juvenile salmon; (2) determine the best method for returning pump-passed juvenile salmon at Red Bluff back into the Sacramento River using present bypass facilities combined with variable releases of flows down existing drum screen bypass pipes; and (3) complete initial development and testing of an internal helical pump (16-inch orifice) attached to the intake of holding tank No. 4 at the Tracy Fish Collection Facility.

Fish mortality and injury was minimal for both Archimedes and internal helical pumps (1-2 percent, at most, for passed fish; nearly zero losses following 96-hr post-treatment holding periods). Though tiny, fish mortality for the helical pump was slightly greater than for the Archimedes pumps. Fish re-distribution to the Sacramento River via existing bypasses at Red Bluff was greatly assisted by using pulsed flows in bypass pipes. All indications are that this new pumping technology will be acceptable for broad application in the near future. Mid-Pacific Region; Northern California Area Office; Willows Construction Office; Tracy Projects Office; USFWS; NMFS; California Departments of Fish and Game and Water Resources; Virginia Tech University

Borthwick, S.M, R.R. Corwin, and C.R. Liston. 1999. Investigations of fish entrainment by Archimedes and internal helical pumps at the Red Bluff Research Pumping Plant, Sacramento River, California: February 1997 - June 1998. Red Bluff Research Pumping Plant Report Series, Volume 7. Bureau of Reclamation, Denver Technical Service Center and Mid-Pacific Region. 51 pp.

Frizell, K.W., and S.P. Atkinson. 1999. Engineering Evaluation of the Red Bluff Research Pumping Plant on the Sacramento River in Northern California: 1995-1998. Red Bluff Research Pumping Plant Report Series, Volume 5. Bureau of Reclamation, Denver Technical Service Center and Mid-Pacific Region. 58 pp.